



WRC-23 Results & WRC-27 Outlook

International Spectrum Sharing Workshop

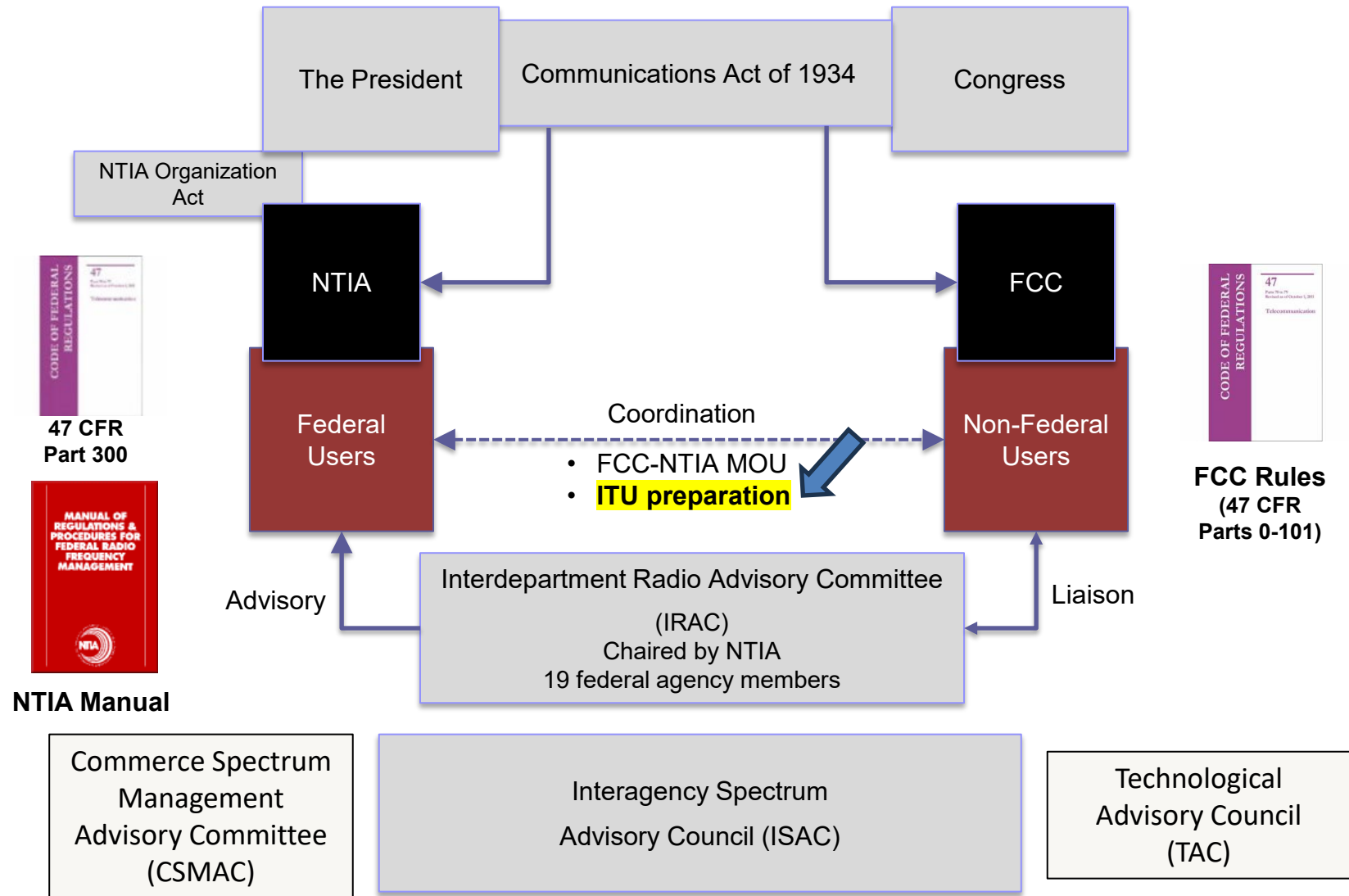
June 27, 2024

Eric Lee, Terrestrial Team Lead
International Spectrum Policy Division
Office of Spectrum Management

Preview

- The Role of NTIA/OSM in U.S. Spectrum Management
- ITU and WRC
- The International WRC Preparatory Process
- The U.S. WRC Preparatory Process
- Results of WRC-23
- Outlook for WRC-27
- How to Engage

U.S. Spectrum Management



NTIA's Principal Responsibilities and Functions

- Serves as the principal executive branch adviser to the President on telecommunications and information policy;
- **Develops and presents U.S. plans and policies at international communications conferences and related meetings;**
- Prescribes policies for and manages Federal use of the radio frequency spectrum;
- Serves as the principal Federal telecommunications research and engineering laboratory, through NTIA's Institute for Telecommunication Sciences, headquartered in Boulder, CO;
- Administers Federal programs to assist telecommunication facilities, public safety organizations, and the general public with the transition to digital broadcasting;
- Provides grants through various programs to increase broadband accessibility in underserved areas of the United States.

Office of Spectrum Management

- Manages the federal government's use of the radio frequency spectrum
- Formulates spectrum policy concerning the allocations and regulations governing federal spectrum use
- **Leads federal participation in World Radiocommunication Conferences and related technical and regional activities**
- Certifies spectrum availability for future government systems
- Assigns frequencies, maintain the Government Master File
- Participates in federal emergency readiness activities
- Supports the administration's commitments, such as making spectrum available for wireless broadband

International Telecommunication Union (ITU)



International Telecommunication Union (ITU)

- ITU is the United Nations specialized agency for information and communication technologies (ICTs)
 - 193 Member States
 - 1000+ Sector Members and Associates
 - www.itu.int
- Structure of the ITU
 - Plenipotentiary Conference (the primary governing body – all powerful)
 - Council (acts on behalf of the Plenipotentiary Conference)
 - Core Sectors (ITU-R, ITU-T, ITU-D)
 - Radiocommunication Sector (ITU-R) – including World Radiocommunication Conferences
 - Telecommunication Standardization Sector (ITU-T)
 - Telecommunication Development Sector (ITU-D)

Radiocommunication Sector (ITU-R)

Space Services >



- BRIFIC
- SNL
- SNS
- Space Plans

Terrestrial Services >



- BRIFIC
- GLAD
- MARS
- WISFAT

Radiocommunication Study Groups >



Study Groups:	1	3	4	5	6	7
	CCV		CPM			

Radio Regulations >



World Radiocommunication Conference (WRC)



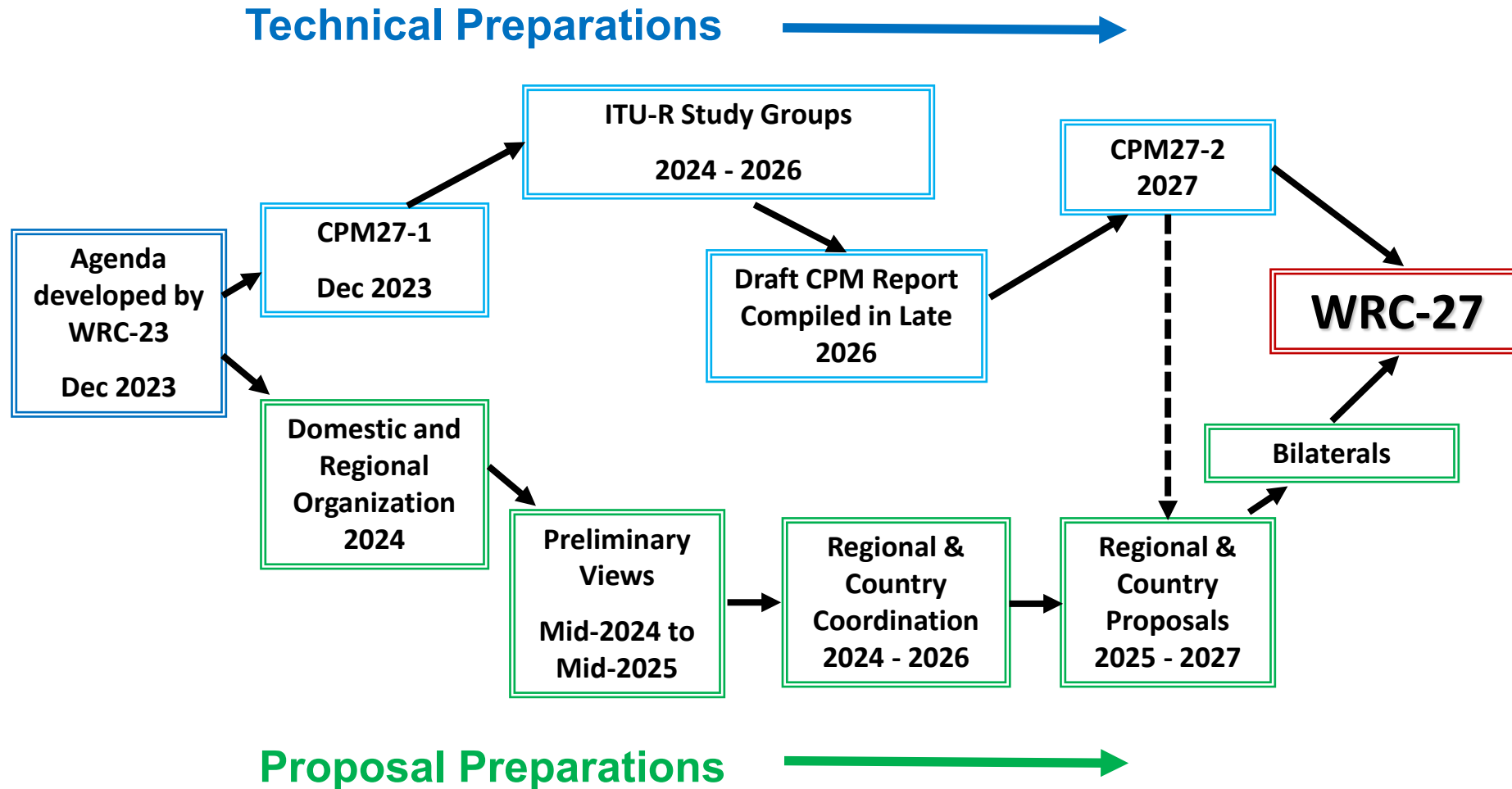
U.S. Department of Commerce · National Telecommunications and Information Administration



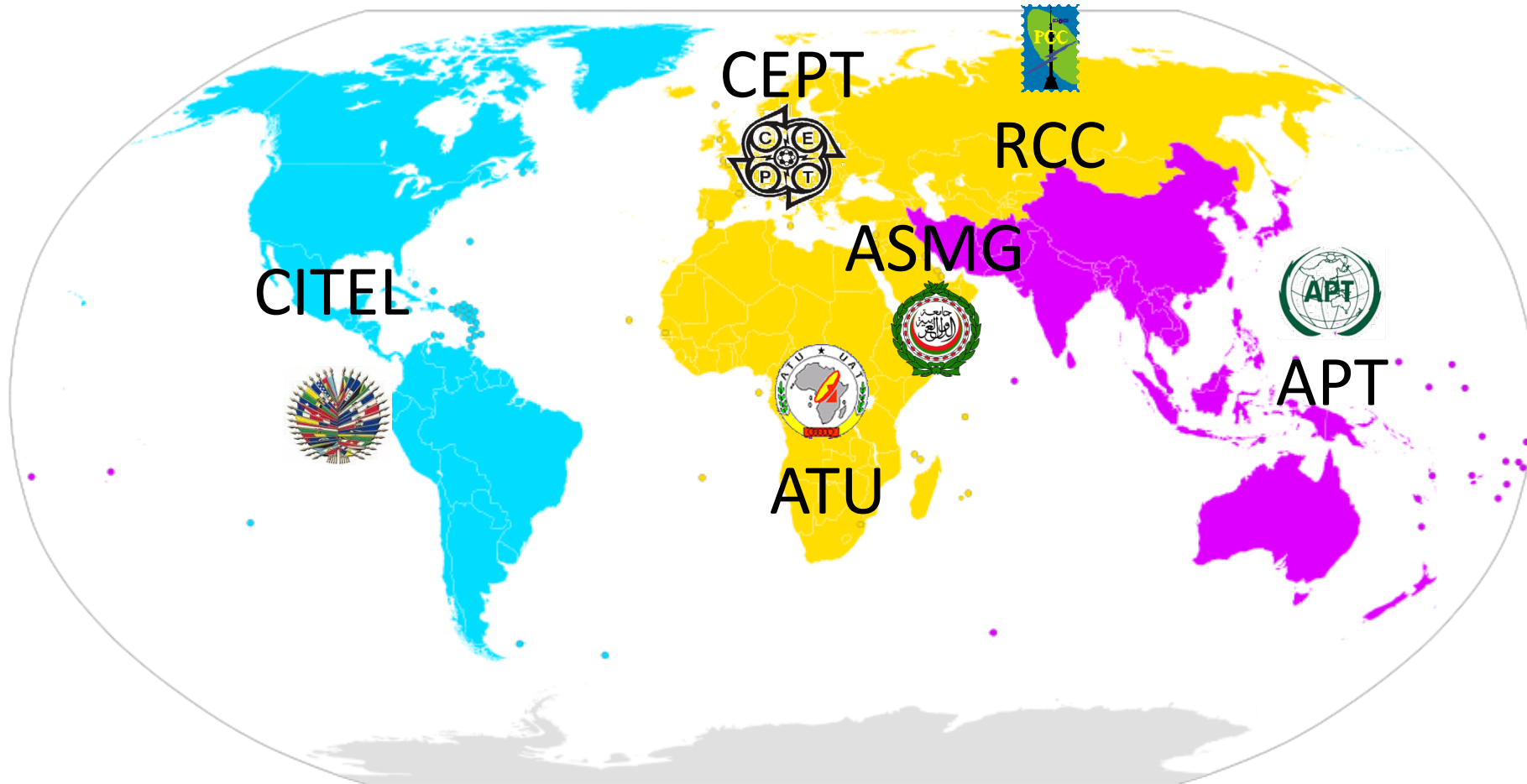
World Radiocommunication Conference (WRC)

- WRCs are held every three to four years. It is the job of WRC to review, and, if necessary, revise the Radio Regulations, the international treaty governing the use of the radio-frequency spectrum and the geostationary-satellite and non-geostationary-satellite orbits
- Preparation for WRCs, such as conducting sharing and compatibility studies, are done in the ITU-R Study Groups
- The Conference Preparatory Meetings (CPMs) prepares a CPM report as a contribution to the WRC
- WRC-23 was held in Dubai, United Arab Emirates, from 20 November to 15 December 2023
- WRC-27 host is yet to be determined

International WRC Preparatory Process



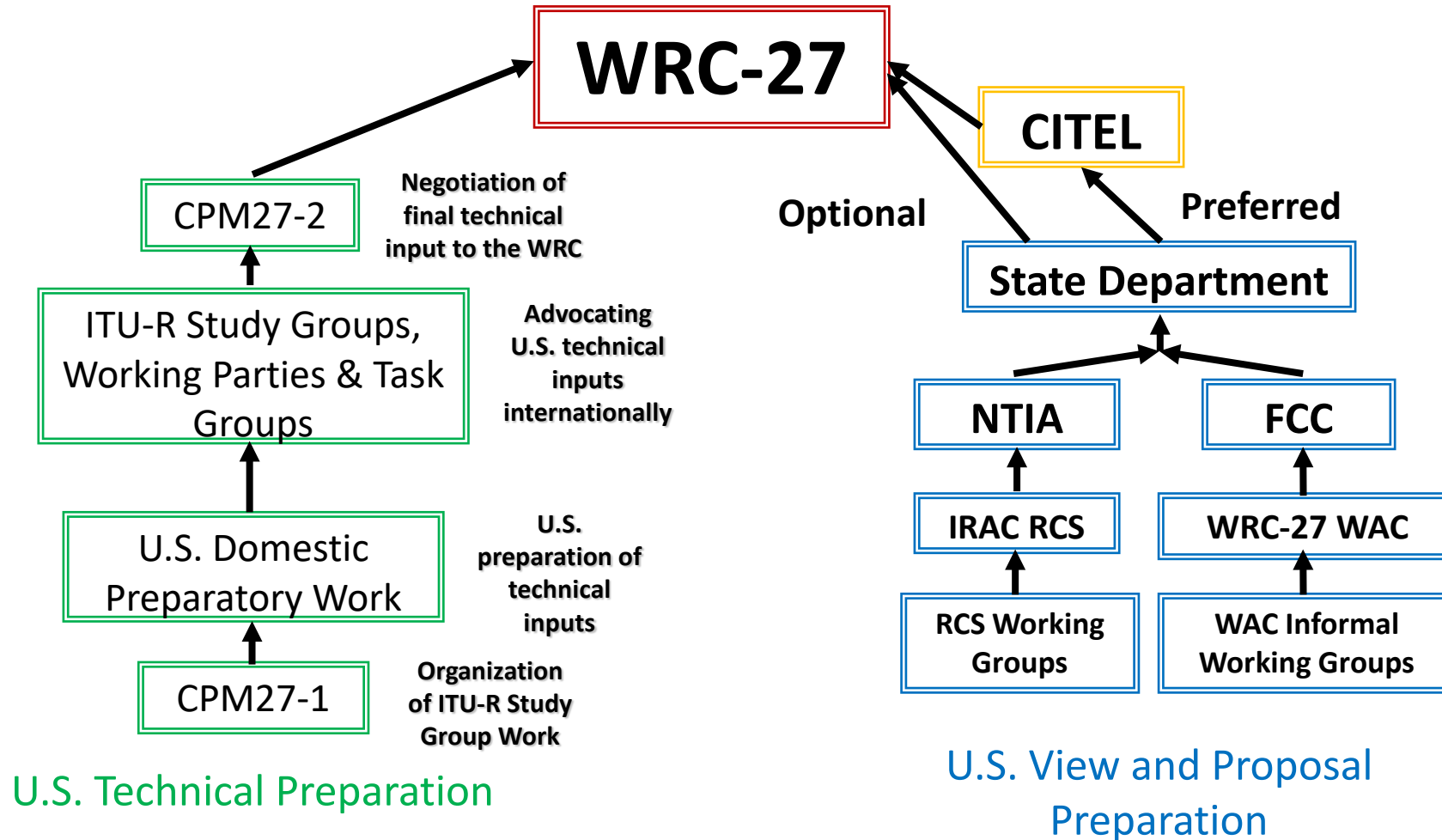
Regional Telecommunication Organizations



Regional Telecommunication Organizations

- Six main regional groups
 - **CITEL** – Inter-American Telecommunication Commission, 35 members
 - **CEPT** – European Conference of Postal and Telecommunication Administrations, 48 members
 - **APT** – Asia Pacific Telecommunity, 38 members
 - **ASMG** – Arab Spectrum Management Group, 22 members
 - **ATU** – African Telecommunications Union, 48 members
 - **RCC** – Regional Commonwealth in the Field of Communications, 11 members
- In recent WRCs, the Regional Groups have played increasingly important roles in reaching decisions on difficult issues
- There are other external organization, such as ICAO, IMO, IUCAF, and NATO, which have spectrum interests and contribute to the discussions

U.S. WRC Preparatory Process



U.S. WRC Preparatory Process

- There are two spectrum regulators in the U.S.
 - **NTIA** – Represents Federal Government Agencies
 - The RCS of the IRAC develops federal preliminary views and proposals
 - NTIA forwards views and proposals to the FCC
 - **FCC** – Represents the Private Sector and General Public
 - The FCC's WAC develops private sector preliminary views and proposals
 - The WAC forwards views and proposals to the FCC
- NTIA & FCC coordinate, modify, and reconcile U.S. views and proposals, with State's input as needed
- The State Department submits U.S. views and proposals to CITEL or the ITU

Results of WRC-23 (Highlights)

- Identified additional spectrum for 5G (IMT); maintained spectrum for unlicensed use (WiFi) in the 6 GHz band; and ensured protections for critical services to safeguard national security and public safety (WRC-23 AI **1.1** and **1.2**)
- Agreed to new AMS(R)S allocation to bolster flight safety in oceanic and remote areas (WRC-23 AI **1.7**)
- Upgraded SRS allocation and allocated new inter-satellite services to support more efficient transmission of scientific data at higher rate (WRC-23 AI **1.13** and **1.17**)
- Final Acts WRC-23 (<https://www.itu.int/pub/R-ACT-WRC.16-2024>)

Results of WRC-23 (AI 1.1)

- WRC-23 AI 1.1 - Protection of Aeronautical and Maritime Mobile Stations in the frequency band 4800-4990 MHz
- Background:
 - WRC-19 identified 4800-4990 MHz for IMT in 39 countries by RR 5.441B, subject to a PFD limit and agreement seeking procedure of No. 9.21 as well as conditions contained in Res. 223
 - AI 1.1 called for studies to review the technical and regulatory conditions
- Results:
 - No change in PFD limit
 - Regulatory and technical conditions in No. 5.441B unchanged due to diverging views
 - 14 R1 and R2 countries were added to RR 5.441B, 7 R1 countries deleted

Results of WRC-23 (AI 1.2)

- WRC-23 AI 1.2 - IMT identifications in frequency ranges 3.3 GHz, 3.7 GHz, 6 GHz and 10GHz
- Background:
 - AI 1.2 calls for studies to identify IMT in the following frequency bands
 - 3 600-3 800 MHz and 3 300-3 400 MHz (Region 2);
 - 3 300-3 400 MHz (amend footnote in Region 1);
 - 7 025-7 125 MHz (globally);
 - 6 425-7 025 MHz (Region 1);
 - 10.0-10.5 GHz (Region 2),
- Protection of services to which the frequency bands were allocated on a primary basis should be ensured

Results of WRC-23 (AI 1.2) Cont.

Band, MHz	Region	WRC-23 decisions	RR provisions
3 300 – 3 400	R1	IMT identification in 16 additional countries (mainly African)	MOD 5.429B
	R2	Allocation for MOB and identification for IMT for entire R2	MOD Table, 5.429D
	R3	IMT identification in 1 additional country (Singapore)	MOD 5.429F
3 600 – 3 700	R2	IMT identification for entire R2	MOD 5.434
3 700 – 3 800	R2	IMT identification in 15 countries	ADD 5.435B (5.36A12)
6 425-7 125	R1	IMT identification for entire R1	ADD 5.457E (5.6A12)
	R2	IMT identification in 2 R2 countries (Brazil, Mexico)	ADD 5.457F (5.6C12)
6 425-7 025	R3	IMT identification in 3 R3 countries (Cambodia, Lao P.D.R., Maldives)	ADD 5.457D (5.6B12).
7 025-7 125	R3	IMT identification for entire R3	ADD 5.457E (5.6A12)
10-10.5 GHz	R2	IMT identification in 12 R2 countries	ADD 5.480A (5.10B12)

Source: APG27-1-INF-01

Results of WRC-23 (AI 1.7)

- WRC-23 AI 1.7 - Possible new aeronautical mobile-satellite (R) service (AMS(R)S) allocation within the frequency band 117.975-137 MHz to support aeronautical VHF communications
- Background
 - The new allocation to the AMS(R)S considered under AI 1.7 was envisioned to relay standard VHF communications operating under the AM(R)S, and to complement terrestrial infrastructures over oceanic and remote areas, without requiring modification to aircraft equipment, as the space segment would be able to receive and transmit to standard VHF radios already installed on board aircraft.
- Results
 - Allocation of 117.975 – 137 MHz to AMS(R)S service under the conditions contained in the Resolution 406, which ensured protection of terrestrial VHF links and adjacent science services.

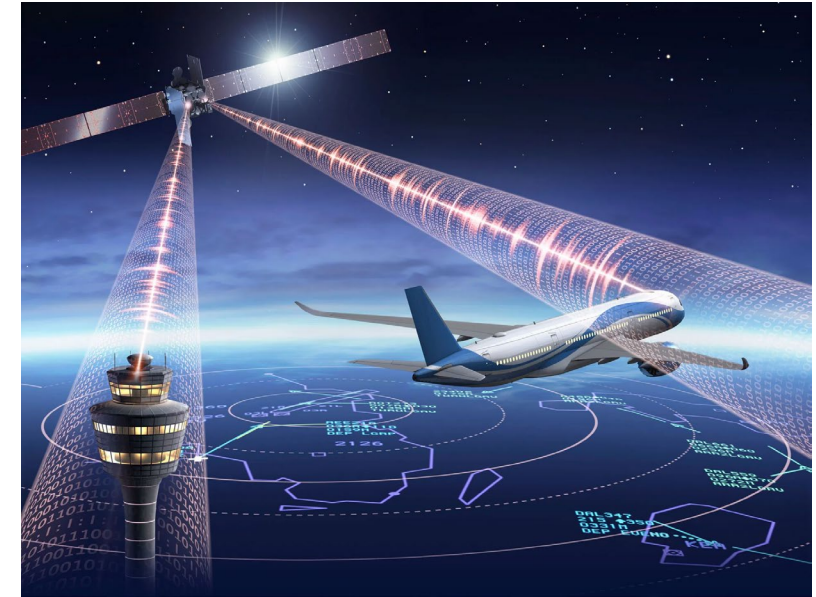


Image Source: ITU News Magazine

Results of WRC-23 (AI 1.13 & 1.17)

- WRC-23 AI 1.13 - possible upgrade to primary status to SRS in the frequency range 14.8-15.35 GHz
- WRC-23 AI 1.17 – Study of technical and operational issues, and regulatory provisions for satellite-to-satellite links in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz
- Results:
 - Upgraded SRS in the 14.8-15.35 GHz with certain limitations
 - Allocated primary inter-satellite service in the 18.1-18.6, 18.8-20.2 and 27.5-30 GHz with certain limitations

WRC-27 Outlook (Highlights)

- 19 specific WRC-27 agenda items plus standing items
- WRC-27 is a very space-heavy cycle
 - Six WRC-27 AIs on Fixed Satellite Service
 - Four WRC-27 AIs on Mobile Satellite Service
 - Five WRC-27 AIs on Science Services
- Only four terrestrial WRC-27 AIs
 - AI 1.7, Terrestrial Mid-Band IMT
 - AI 1.8, Radiolocation above 231.5 GHz
 - AI 1.9, Appendix 26 aeronautical HF modernization
 - AI 1.10, Article 21 PFD and EIRP limits for FSS, MSS, and BSS at 70 and 80 GHz
- Multiple AIs require close collaborations between different ITU-R Working Parties
- Large number of overlapping frequency bands between agenda items
- General deadline on criteria, characteristics and methodologies on the 31 December 2024



FIXED-SATELLITE AND BROADCASTING-SATELLITE

MOBILE-SATELLITE

- 1.1 Aeronautical/maritime earth stations in motion
47.2-50.2 GHz / 50.4-51.4 GHz
- 1.2 13.75-14 GHz – FSS earth stations with smaller antennas
- 1.3 51.4-52.4 GHz – Gateway earth stations for NGSO FSS
- 1.4 17.3-17.7/8 GHz – FSS/BSS allocations in 17 GHz in Region 3
- 1.5 Unauthorized operations of NGSO earth stations
- 1.6 Equitable access to FSS in the bands
37.5-42.5 GHz / 42.5-43.5 GHz / 47.2-50.2 GHz / 50.4-51.4 GHz
- 7 Satellite regulatory issues

- Space-to-space links
1 518-1 544 MHz / 1 545-1 559 MHz
1 610-1 645.5 MHz / 1 646.5-1 660 MHz
1 670-1 675 MHz / 2 483.5-2 500 MHz
1.11
- MSS - IoT development
1427-1432 MHz / 1645.5-1646.5 MHz 1880-1920 MHz / 2010-2025 MHz
1.12
- MSS - IMT- direct connectivity
1.13
- MSS – additional allocation
1.14

- 1.7 4400-4800 MHz / 7125-8400 MHz / 14.8-15.35 – IMT
- 1.8 231.5-275 GHz / 275-700 GHz – Radiolocation
- 1.9 Aeronautical mobile (OR) high frequency modernization
- 1.10 71-76 GHz / 81-86 GHz – Power flux-density / power limits

- Lunar communications
1.15
- Radio Quiet Zones
1.16
- Space weather sensors
1.17
- ≥ 76 GHz – Earth exploration and radio astronomy
1.18
- Earth exploration-satellite service
4200 – 4400 MHz / 8400-8500 MHz
1.19

FIXED, MOBILE AND RADIOLOCATION

SCIENCE



Source: APG27-1-INF-01



ITU-R Preparatory Studies for WRC-27

WRC-27 agenda Item (Chapter)	Topic	WRC Resolution (*)	Responsible Group(s)	Information from Responsible Group(s) [1][5]
1		-	-	-
1.1 (1)		Res.176 (Rev.WRC-23)	WP 4A	Doc. 4A/128 (d) (a), Annex 1 (b), Annex 2
1.2 (1)		Res.129 (WRC-23) (ex.COM6/1)	WP 4A (1)	Doc. 4A/128 (d) (a), Annex 3 (b), Annex 4
1.3 (1)		Res.130 (WRC-23) (ex.COM6/3)	WP 4A	Doc. 4A/128 (d) (a), Annex 5 (b), Annex 6
1.4 (1)		Res.726 (WRC-23) (ex.COM6/24)	WP 4A	Doc. 4A/128 (d) (a), Annex 7 (b), Annex 8, Annex 9 (c)
1.5 (1)		Res.14 (WRC-23) (ex.COM6/6)	WP 4A	Doc. 4A/128 (d) (a), Annex 10
1.6 (1)		Res.131 (WRC-23) (ex.COM6/7)	WP 4A	Doc. 4A/128 (d) (a), Annex 11 (b), Annex 12, Annex 13
1.7 (2)		Res.256 (WRC-23) (ex.COM6/26)	WP 5D	Doc. 5D/77 (d), Chapter 1 (a), Chapter 2 Annex 2.24.7 (b), Chapter 4 Sec. 1, 2 & 3.6, Annex 4.10
1.8 (2)		Res.663 (Rev.WRC-23)	WP 5B	Doc. 5B/96 (d) (a)
1.9 (2)		Res.411 (WRC-23) (ex.COM6/2)	WP 5B	Doc. 5B/96 (d) (a), Annex 1 (b)
1.10 (2)		Res.775 (Rev.WRC-23)	WP 5C (2)	Doc. 5C/69 (d) (a), Annex 2 (a), Annex 4 (a)(b)
1.11 (3)		Res.249 (Rev.WRC-23)	WP 4C	Doc. 4C/77 Sec. 2.3, 2.4, 3.1.1, 4.1 & 4.1.1 (d), Annex 1, Annex 2 (b)
1.12 (3)		Res.252 (WRC-23) (ex.COM6/8)	WP 4C	Doc. 4C/77 Sec. 2.3, 2.4, 3.1.2, 4.1 & 4.1.2 (d), Annex 3, Annex 4 (b)
1.13 (3)		Res.253 (WRC-23) (ex.COM6/9)	WP 4C (3)	Doc. 4C/77 Sec. 2.3, 2.4, 3.1.3, 4.1 & 4.1.3 (d), Annex 6 (b), Annex 7
1.14 (3)		Res.254 (WRC-23) (ex.COM6/10)	WP 4C	Doc. 4C/77 Sec. 2.3, 2.4, 3.1.4, 4.1 & 4.1.4 (d), Annex 8, Annex 9 (c), Annex 10 (b)
1.15 (4)		Res.680 (WRC-23) (ex.COM6/4)	WP 7B	Doc. 7B/35 Sec. 2.2, 3.2, 3.2.1, 3.4, 3.4.1, 3.4.2 & 4 (d), Annex 1 (b), Annex 2 (f), Annex 3
1.16 (4)		Res.681 (WRC-23) (ex.COM6/11)	WP 7D	Doc. 7D/41 Sec. 2.1, 2.2 & 2.2.1 (d), Annex 1 (b), Annex 11 (e)
1.17 (4)		Res.682 (WRC-23) (ex.COM6/12)	WP 7C	Doc. 7C/41 Sec. 2.1, 2.3, 4, 4.1 & 8.1 (d), Annex 1 (e), Annex 3 (f), Annex 10 (b)
1.18 (4)		Res.712 (WRC-23) (ex.COM6/5)	WP 7C WP 7D (4)	Doc. 7C/41 Sec. 2.1, 2.3, 5.3.1 & 8.1 (d), Annex 9 Doc. 7D/41 Sec. 2.1, 2.2 & 2.2.2 (d), Annex 2 (b), Annex 3 (f)
1.19 (4)		Res.674 (WRC-23) (ex.COM4/8)	WP 7C	Doc. 7C/41 Sec. 2.1, 2.3, 5.1, 5.2 & 8.1 (d), Annex 8 (f)

- See Resolution 813 (WRC-23) for full list of WRC-27 Agenda Items
- <https://www.itu.int/en/ITU-R/study-groups/rcpm/Pages/wrc-27-studies.aspx>

WRC-27 Outlook (AI 1.7)

- WRC-27 AI 1.7 will consider, based on results of studies, the identification of following frequency band(s) for the terrestrial component of IMT:
 - 4 400-4 800 MHz, or parts thereof, in Region 1 and Region 3;
 - 7 125-8 400 MHz, or parts thereof, in Region 2 and Region 3;
 - 7 125-7 250 MHz and 7 750-8 400 MHz, or parts thereof, in Region 1;
 - 14.8-15.35 GHz
- 4 400-4 800 MHz is
 - Allocated to FS, MS, and FSS on a primary basis;
 - Adjacent to 4 200-4 400 MHz Aeronautical Radionavigation service reserved exclusively for radio altimeters;
 - Part of APPENDIX 30B provisions and associated Plan for the FSS

WRC-27 Outlook (AI 1.7) Cont.

- 7 125-8 400 MHz is allocated on a primary basis to
 - EESS - Earth Exploration Satellite Service
 - FS - Fixed Service
 - FSS – Fixed Satellite Service
 - MetSat - Meteorological Satellite Service
 - MMSS - Maritime Mobile Satellite Service
 - MS - Mobile Service
 - MSS - Mobile Satellite Service
 - SOS - Space Operation Service
 - SRS - Space Research Service
- 14.8-15.35 GHz is
 - Allocated to FS, MS, and SRS on a primary basis;
 - Adjacent to 15.35-15.4 GHz band where No. 5.340 applies

WRC-27 Outlook (AI 1.9)

- WRC-27 AI 1.9 will consider appropriate regulatory actions to update Appendix 26 to the Radio Regulations in support of aeronautical mobile (OR) high frequency modernization
- Background:
 - Modern wide band HF (WBHF) technologies enable the flexibility to use wider channel bandwidths with advanced digital modulations;
 - Currently, appendix 26 allows a maximum bandwidth of 2.8 kHz for AM(OR)S;
 - Studies will need to be performed to show compatibility of wider channels with incumbent services

WRC-27 Outlook (AI 1.15)

- WRC-27 AI 1.15 will consider studies on frequency-related matters, including possible new or modified space research service (space-to-space) allocations, for future development of communications on the lunar surface and between lunar orbit and the lunar surface
- Background:
 - In the United States, the near-term scientific exploration and discovery objectives are currently being undertaken by NASA in collaboration with US industry partners and numerous space agencies around the world under the Artemis Program
 - Studies will need to be performed to show compatibility between that new or modified SRS allocations for lunar surface and lunar orbit-to-surface application and incumbent services



Image Source: NASA Artemis Homepage

How to Engage

- Participate in the technical ITU-R Study Group work in the prep process
 - Follow the responsible ITU-R Study Group for agenda items of interest (typically WP4s, 5s, or 7s)
 - Contribute as members of administrations' delegations or as sector members
- Participate in the development of views, positions and proposals in the U.S. process
 - Non-federal participants can contribute to the WRC-27 WAC (<https://www.fcc.gov/wrc-27>)
 - Federal participants can contribute to the IRAC RCS (<https://www.ntia.gov/page/radio-conference-subcommittee-rcs>)

Questions?